

In another implementation, a method of providing environment information includes: receiving an environment information request from a client through a network connection; retrieving environment information for each of two or more environments from an environment database; generating an environment report according to said retrieved environment information; and sending said environment report to said client through said network connection; wherein environment information for an environment includes network information for the environment, status information for the environment, and user count information for the environment.

In another implementation, a method of accessing environment information includes: sending an environment information request from a client to an environment information server through a network connection; and receiving from said environment information server an environment report including environment information for two or more environments; wherein environment information for an environment includes network information for the environment, status information for the environment, and user count information for the environment.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a representation of one implementation of an environment information server connected to a network.

Figure 2 is a block diagram of one implementation of an environment information server.

Figure 3 shows a flow chart of one implementation of accessing environment information.

Figure 4 is a flow chart of one implementation of retrieving environment information.

Figure 5 is a flow chart of updating environment information in an environment information server.

#### DETAILED DESCRIPTION

The present invention provides methods and apparatus implementing techniques for providing network environment information. In one implementation, an environment information server stores environment information for multiple network environments in a database. Upon receiving a request for environment

information from a client, the environment information server builds an environment report using environment information retrieved from the database and sends the report to the client. The client uses the environment report to determine to which environment to connect.

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An example of one implementation is described below. Additional variations are described after this example.

In one example of one implementation, an environment information server and three network environments are connected to the Internet. Each environment includes multiple interconnected computer systems and supports one or more online games. The environment information server includes a database storing environment information for each of the environments supported by the environment information server. The environment information for an environment indicates a name of the environment, a description of the environment, the status of the environment, network information for communicating with the environment, the current number of clients connected to the environment, and the maximum number of clients that are permitted to be connected to the environment.

A client system is also connected to the Internet. The client system is a network-enabled game console, such as a PlayStation 2™ offered by Sony Computer Entertainment Inc.™ For a user to play an online game through one of the environments, the user will connect the game console to one of the environments through the Internet. Before connecting to one of the environments, the game console connects to the environment information server to retrieve environment information for the available environments. The game console requests environment information from the environment information server. The environment information server retrieves environment information from the database and builds an environment report for the game console. The environment information server sends the environment report to the game console. The game console closes the connection to the environment information server and presents information from the environment report to the user to allow the user to select one of the environments. The user reviews the information presented by the game console and selects the environment most desirable to the user (e.g., the environment which appears to have the best performance at this time). After receiving a selection from the user, the game console connects to the selected environment and begins the online game process.

In this way, the user of the game console has access to information describing the environments available for an online game through a central source – the environment information server. Rather than contacting each environment directly from the game console, the user can retrieve one set of information to select a desirable environment. In addition, a service provider can deploy multiple environments (e.g., based on geographic separation or language separation) and allow users to connect to an appropriate environment while still allowing users to select to which environment to connect.

Figure 1 shows a representation of one implementation of an environment information server 105 connected to a network 110. One or more network environments 115<sub>1</sub>...N and a client system 120 are also connected to the network 110. An environment information database 125 is connected to the environment information server 105.

Each of the environments 115<sub>1</sub>...N includes one more interconnected computer systems providing one more network services to connected clients. In one implementation, the network services include supporting one or more online games. For example, in one implementation, an environment is an online universe supporting an online game. The universe includes: a universe manager for tracking and managing lobby rooms, game information, and players; an authentication server for authenticating clients; a lobby server for supporting the lobby rooms; a proxy server; a database server; and a game server (which may be connected through the proxy server). A user connects to the universe to play the online game using a network-enabled game console (e.g., by connecting to the authentication server for authentication, connecting to the lobby server to access one or more lobby rooms, and then connecting to the game server to play the game). More than one environment can support the same service, however each environment operates independently of the other environments. As a result, a client can connect to one of multiple environments to access a particular service. In addition, different environments may provide the same primary services but provide different ancillary services, such as different advertising.

Depending upon the network conditions and status of the environments, different environments may provide different levels of performance at a given time. For example, a user playing an online game may experience different levels of

performance in the game (e.g., different frame rates) from different universes. In one implementation, the environments are physically remote from one another (e.g., on different continents), and so the latency or delay in receiving data from an environment may vary according to the distance between the client and the environment (e.g., due to physical distance and/or network configuration). Similarly, if the network path to an environment from a client is not operating properly or is operating slowly, the performance of that environment for the client may be worse than that for a different environment. In another situation, as the number of clients connected to an environment increases, the load on the computer systems of the environment increases, and so the performance of the environment may degrade. In another situation, one environment providing a desired service may be unavailable (e.g., the computer systems of the environment are disconnected from the network for maintenance or repair), and so a user may need to connect to an alternative environment to access the service.

The environment information server 105 is a network server system including one or more interconnected computer systems. The computer systems of the environment information server 105 are connected forming a local network. Alternatively, the computer systems of the environment information server are integrated into a single system. The environment information server 105 stores environment information for each of the environments  $115_1 \dots N$  in the environment information database 125. As described below, the environment information server 105 receives requests for environment information from the client system 120 and returns environment reports to the client system 120 using environment information retrieved from the environment information database 125. In another implementation, the environment information server is connected directly to one more environments.

The environment information server 105 periodically polls the environments  $115_1 \dots N$  to update the environment information for the environments  $115_1 \dots N$ . In one implementation, the environment information server also requests environment information from an environment when the environment information server has received a request for environment information for an environment for which the environment information server has not stored current environment information. In this case, the environment information server requests new environment information

from the appropriate environment and stores the updated environment information in the environment information database.

5 The environment information stored by the environment information server for an environment includes, but is not limited to, information indicating: the name of the environment, a description of the environment (e.g., a text description of the environment), the status of the environment, network information for the environment (e.g., including the fully qualified domain name and the port number for connecting to the environment), user count information for the environment (e.g., the current number of users or clients connected to the environment and/or the maximum number of users or clients that are permitted to be connected to the environment), latency  
10 information for the environment (e.g., estimated relative to a sample client or base information for estimating latency relative to the requesting client), performance information for the environment (e.g., estimating response time or data rates such as frame rates), news or announcements for the environment (e.g., upcoming events, announcements by the provider operating the environment, announcements by the provider of a service supported by the environment, available discounts or pricing, advertising), costs or fees for the environment, and a list of available services  
15 supported by the environment.

The environment information server 105 prepares an environment report using  
20 the environment information stored in the environment information database 125. The environment information server 105 prepares the environment report in response to a request received from the client system 120. In one implementation, the environment information server 105 uses the same format for each environment report (e.g., reporting the same type of information in each report). In one implementation,  
25 the environment information server 105 includes a recommendation of which environment  $115_1 \dots N$  to use based on current conditions of the environments  $115_1 \dots N$  according to the stored environment information.

In another implementation, the environment information server 105 uses client-specific information included by the client system 120 in the request sent to the  
30 environment information server 105 to prepare the environment report. For example, the environment information server 105 derives latency and performance information relative to the specific requesting client system 120 using network information provided by the client system 120. In another example, the environment information server 105 prepares news or announcements specific to the requesting client system

120 using client identification information provided by the client system 120 (e.g., providing announcements targeted to the client system based on one more subscriptions corresponding to the client system or a group to which the client system belongs). In another example, the environment information server 105 prepares a  
5 recommendation of which environment  $115_1 \dots N$  best matches criteria supplied in the request from the client system 120. In another example, the environment information server 105 builds a list of other users accessing the environment using client identification information provided by the client system 120 (e.g., building a buddy list).

10 The network 110 is a data network, such as the Internet. In another implementation, the network 110 is a private network, such as a corporate intranet. In another implementation, part or the entire network is a wireless network.

The client system 120 is a network-enabled computer system, such as a game console with a network adapter, or a laptop computer having a wireless modem  
15 providing a wireless connection to the network 110. The client system 120 exchanges data with the environment information server 105 through the network 110. In another implementation, the client system is connected directly to the environment information server.

The environment information database 125 is a typical database system, such  
20 as a relational database. The environment information database 125 receives requests for data from the environment information server 105 and provides stored environment information to the environment information server 105. In another implementation, the environment information database is connected to the environment information server through the network. Alternatively, the environment  
25 information database is included within the environment information server.

Figure 2 is a block diagram of one implementation of an environment information server 200. The environment information server 200 includes a server controller 205, a request handler 210, an environment information database 215, and a network connection 220. The server controller 205 controls the operation of the  
30 environment information server 200 and its components. The other components of the environment information server are connected to the server controller 205. The network connection 220 is connected to a network, such as the Internet. The environment information server 200 communicates with clients and environment through the network connection 220.

The request handler 210 processes requests for environment information received from clients (e.g., when the environment information server 105 receives a request for environment information from the client system 120, as shown in Figure 1). The request handler 210 retrieves environment information from the environment information database 215 according to the received request. The request handler 210 builds an environment report using the retrieved environment information. In one implementation, the request handler 210 derives data from the environment information and from information included in the request from the client. In another implementation, the request handler returns the retrieved environment information unmodified to the client.

In other implementations, the configuration of the environment information server can be different. For example the systems of the environment information server can be discrete network systems interconnected in a local network, or interconnected across a broader network. In another example, the environment information database can be external to the environment information server (e.g., as shown in Figure 1). In another example, the components of the environment information server are interconnected using a common bus structure.

Figure 3 shows a flow chart 300 of one implementation of accessing environment information. Initially, a client system is connected to an environment information server through a network. The environment information server stores environment information for one or more environments in a connected environment information database.

The client opens a connection to the environment information server, block 305. The environment information server confirms the connection. In one implementation, the client system and environment information server establish a secure connection, such as by using encryption. In another implementation, upon opening the connection, the environment information server confirms that the client system is authorized to access the environment information server, such as by checking a client identifier (e.g., identifying a specific client system or a type of client system, such as a specific product) or requesting a password or key. In another implementation, if the connection to the confirming information server is unavailable or fails, the client system has a default environment to which to connect.

The client generates an environment information request, block 310. The environment information request indicates that the client system is requesting

environment information for available environments from the environment information server. In one implementation, the client system includes in the environment information request information for the environment information server to use in building a response to the request. For example, in one implementation, the client system includes client identification information in the request. In another example, the client system includes network information for the client system in the request, such as the network address of the client system. In another example, the client system includes one more criteria for selecting or recommending an environment.

10           The client sends the environment information request to the environment information server, block 315. The client system sends the request to the environment information server through the network. The environment information server processes the request and builds an environment report as described below referring to Figure 4.

15           The client receives the environment report from the environment information server, block 320. The client system receives the environment report through the network. After receiving the environment report, the client closes the network connection to the environment information server, block 325.

          The client builds an environment presentation using the received environment report, block 330. The environment presentation presents information from the environment report formatted according to the configuration of the client system. The environment presentation includes a request for a selection of the environment by a user, such as through a list of available environments and corresponding environment information (e.g., presenting a name, description, status and performance information for each available environment). In one implementation, the environment presentation includes a recommendation of an environment by the environment information server or the client system. The recommendation can be based upon criteria used by the environment information server, the client system, or criteria provided by the user. In one implementation, the client system uses stored user preferences to build the environment presentation. For example, the client system can provide a recommendation for selecting an environment based on previously entered user preferences. After building the environment presentation, the client presents the environment presentation to a user, block 335. The client presents the environment



presentation through a user interface, such as a display connected to or part of the client system.

The client receives a selection of the environment by the user, block 340. The user selects one of the available environments as presented in the environment presentation using the user interface of the client system, such as a keypad or remote control (e.g., using a game controller for a game console).

The client opens a network connection to the selected environment, block 345. The client system uses the network information provided by the environment information server in the environment report to connect to the selected environment. After establishing a connection to the environment, the client system accesses services provided by the connected environment, block 350. In one implementation, the environment provides an online game and once the client system has connected to the environment, the user of the client system can begin to play the provided game.

In another implementation, the client system automatically connects to a recommended environment instead of requesting a selection by the user. In this case, the environment information server or the client system selects an environment using the environment information and the client system opens a connection based upon the selection. In one implementation, the access to the environment information server is transparent to the user. For example, the user requests access to a specified online game. The client system automatically generates and sends an environment information request to the environment information server to determine which environment provides the requested game and which of those environments will provide the most desirable level of performance. The determination can be made by the game console or the environment information server. The client system then automatically connects to the indicated environment. From the user's point of view, the user requested access to a game and a connection to an environment providing the game was opened by the client system automatically. In this case, the user is not necessarily informed of the number or presence of various available environments.

Figure 4 is a flow chart 400 of one implementation of retrieving environment information. Initially, an environment information server is connected to an environment information database and is connected to a client system through a network. The client system has generated an environment information request and sent the request to the environment information server through the network, as described above referring to block 315 of Figure 3.

The environment information server receives the environment information request from the client system, block 405. As described above, the environment information request is a request for environment information for available environments. In one implementation, the environment information request indicates information for the environment information server to use to select environment information and build the environment report, such as information indicating a specific service, client identification information, client network information, and/or criteria for selecting an environment.

The environment information server retrieves environment information from the environment information database, block 410. The environment information server retrieves environment information for each of the available environments from the environment information database. The environment information server sends a query to the database, and the database returns environment information matching the query. In one implementation, the environment information server retrieves information according to the environment information request, such as by building a database query for the environment information database using criteria in the environment information request. In this case, the environment report can reflect environment information specific to the requesting client or user. In one implementation, if the environment information database does not have environment information matching the environment information request or the retrieved environment information is not current, the environment information server requests new environment information from the appropriate environment(s). The environment information server determines whether environment information is current or not by comparing timestamps of the data with the current time and then comparing the difference with a threshold.

The environment information server builds an environment report using the retrieved environment information, block 415. The environment report includes information identifying one or more available environments and network information for connecting to the identified environments (e.g., a domain name and port number). In one implementation, the environment information server uses a standard format for generating the environment report. In another implementation, the environment information server customizes the environment report using information from the environment information request. For example, the environment information server builds the environment report according to a user language indicated in the

environment information request or indicated by client identification information. The environment information server can filter or modify the retrieved environment information or derive data from the environment information for the report. For example, the environment information server estimates latency or performance using  
5 network information for each environment and using network information for the client system. In another example, the environment information server estimates latency or performance using a user count for each of the environments (e.g., reflecting the current load of each of the environments). In another implementation, the environment information server includes information in the environment report  
10 that is independent of the environments, such as news or announcements related to the requesting client or a requested service.

The environment information server sends the environment report to the client system, block 420. The environment information server sends the report to the client through the network.

15 Figure 5 is a flow chart 500 of updating environment information in an environment information server. Initially, an environment information server is connected to an environment information database and connected to one or more environments through a network.

The environment information server checks the network for available  
20 environments, block 505. The environment information server maintains a list of the available environments and the network information for connecting to each available environment. Periodically, the environment information server polls the network for changes in the available environments, such as new environments becoming available or environments becoming unavailable.

25 Beginning with the first environment in the list of available environments, the environment information server connects to the environment, block 510. The environment information server connects to the environment through the network using the stored network information for the environment.

The environment information server requests environment information from  
30 the environment, block 515. The environment information server requests environment information according to what types of environment information are stored by the environment information server. In one implementation, the environment information server first checks the environment information stored for the environment and requests environment information from the environment for

environment information which is no longer current (e.g., environment information having a timestamp more than one week old).

The environment information server receives the requested environment information from the environment, block 520. After receiving the requested  
5 environment information, the environment information server closes the connection to the environment, block 525.

The environment information server stores the received environment information in the environment information database, block 530. In one  
10 implementation, the environment information server stores or changes only the environment information that is different from the environment information already stored in the environment information database. After storing the environment information, the environment information server connects to the next environment in the list of available environments, returning to block 510. After reaching the end of the list of available environments, the environment information server waits for a  
15 predetermined period time and then once again checks for available environments, returning to block 505.

The various implementations of the invention are realized in electronic hardware, computer software, or combinations of these technologies. Some  
20 implementations include one or more computer programs executed by a programmable processor or computer. For example, referring to Figure 1, in one implementation, the environment information server 105, the environments 115<sub>1</sub> ... N, and the client system 120 include one or more programmable processors. In general, each computer includes one or more processors, one or more data-storage components  
25 (e.g., volatile or non-volatile memory modules and persistent optical and magnetic storage devices, such as hard and floppy disk drives, CD-ROM drives, and magnetic tape drives), one or more input devices (e.g., mice and keyboards), and one or more output devices (e.g., display consoles and printers).

The computer programs include executable code that is usually stored in a  
30 persistent storage medium and then copied into memory at run-time. The processor executes the code by retrieving program instructions from memory in a prescribed order. When executing the program code, the computer receives data from the input and/or storage devices, performs operations on the data, and then delivers the resulting data to the output and/or storage devices.

Various illustrative implementations of the present invention have been described. However, one of ordinary skill in the art will see that additional implementations are also possible and within the scope of the present invention. For  
5 example, while the above description focuses on implementations providing online game services, other online services can be supported, such as web access, email, or financial services. In another alternative implementation, rather than the client system being a game console or personal computer system, the client system can be a consumer electronics device, such as a phone or PDA (personal digital assistant).  
10 Accordingly, the present invention is not limited to only those implementations described above.